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DOES CONTRACTING MAKE FARMERS HAPPY? EVIDENCE FROM SENEGAL

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In this paper we use a subjective well-being approach to evaluate the welfare impact of contract-farming. We analyze the impact of contract-farming on self-reported happiness using original panel data from a farm-household survey in the *Niayes* region in Senegal. We use different econometric techniques and show that, when correcting for time invariant unobserved heterogeneity, contract-farming has a positive effect on subjective well-being. We find diverging effects for different types of contracts, suggesting that contract-farming contributes more to farmers' subjective well-being under certain conditions and contract design. Our main finding corroborates earlier findings from empirical studies using cross-sectional data and income-based measures of welfare. In line with earlier results from the subjective well-being literature, we find that absolute income has a positive but decreasing effect on subjective well-being while comparison income has a negative effect. Also household demographic characteristics, their land and livestock assets, and housing indicators affect subjective well-being.

JEL Codes: D60, I32, Q13, Q17

Keywords: contract-farming, farm-households, happiness, subjective well-being

1. Introduction

Contract-farming is still a contentious issue, especially when poor farmers in developing countries are involved. Some authors have argued that contract-farming is used by agro-industrial companies as a tool to extract rents from the food chain (Wilson, 1986; Glover and Kusterer, 1990; Little and Watts, 1994; Porter and Phillips-Howard, 1997). Given the unequal balance of power between large food companies and smallholder farmers, companies could set the terms of the contract to their advantage and exploit farmers. Farmers could thereby lose their autonomy and face increased risk due to their dependency on agri-food

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companies and traders. Other authors have argued that contract-farming reduces transaction costs and can make smallholders overcome existing market imperfections (Key and Runsten, 1999; Swinnen, 2007; Swinnen and Maertens, 2007). Contract-farming could improve farmers' access to inputs, credit, and technology, and ultimately benefit farm productivity and incomes. Risk faced by farmers could be reduced as contracts offer a guaranteed market outlet and, depending on the type of contract, share production risks between farmers and buyers.

A series of recent empirical studies from around the world provide evidence of a positive welfare impact of contract-farming. It has been shown that contract-farming leads to higher productivity, higher profits, and higher net farm incomes; and that contract-farming reduces price variability and leads to higher income stability.[1]

A first critique on all these empirical studies is that they use cross-sectional data and that with such data it is difficult to correct for potential bias in the estimated effects caused by unobserved factors being correlated with participation in contract-farming as well as with the outcome variables of interest (Bellemare, 2012). Most studies either do not attempt to correct for bias caused by unobserved heterogeneity or correct for it using an instrumental variable approach with instruments that are often weak.

A second critique comes from the political economy and rural sociology literature and concerns the narrow focus on monetary outcomes. Empirical studies that focus on non-monetary outcomes have mainly pointed to adverse effects of contract-farming. For example, Eaton and Shepherd (2001), Dolan (2001), and Singh (2003) find that contract-farming increases farmers' labor intensity and creates conflicts over the allocation of land and labor resources between food crops and cash crops. Other authors have stressed the loss in autonomy and the increased vulnerability of contract farmers (e.g., Porter and Phillips-Howard, 1997; Key and Runsten, 1999). Some studies have looked at the impact on the broader economy and pointed out that contract-farming disturbs existing social structures and leads to further economic differentiation (e.g., Korovkin, 1992; Dolan, 2001). These studies usually use more qualitative methods. An exception is the study by Schipmann and Qaim (2011) who analyze the preferences of farmers for specific contracts in Thailand and conclude that farmers prefer not to contract.

The aim of this paper is to make a contribution to address both critiques by (a) using an alternative approach to evaluate the welfare impact of contract-farming, and (b) using panel data. We use a subjective well-being approach, which is based on the idea that other factors besides people's income and wealth affect their welfare as well (Veenhoven, 1994; DeNeve and Cooper, 1998; Gerdtham and

[1]See, for example, Bellemare (2012) for different crops in Madagascar; Birthal *et al*. (2005) for milk, broiler, and vegetable production in India; Cai *et al*. (2008) for rice production in Cambodia; Warning and Key (2002) for peanuts in Senegal; Maertens and Swinnen (2009) for vegetable production in Senegal; McCulloch and Ota (2002) for horticulture production in Kenya; Minten *et al*. (2009) for vegetable production in Madagascar; Miyata *et al*. (2009) for fruit and vegetable production in China; Ramaswami *et al*. (2005) for poultry production in India; Rao and Qaim (2011) for vegetable production in Kenya; Simmons *et al*. (2005) for corn and rice production in Indonesia; Singh (2002) for vegetable farming in India; and Tripathi *et al*. (2005) for potato production in India.

Johannesson, 2001; Ferrer-i-Carbonell, 2005; Frey and Stutzer, 2005). Subjective well-being measures were first used by psychologists but are increasingly used in the economics literature and are argued to be highly complementary to income and consumption approaches for measuring and analyzing welfare (Graham, 2005; Kahneman and Krueger, 2006). A large literature on subjective well-being developed since the 1990s but most of the focus has been on high-income countries. Applications to poor countries only started to emerge more recently (e.g., Hinks and Davies, 2008; Van Landeghem *et al.*, 2013). There is an emerging literature that compares the relationship between subjective well-being and standard measures of poverty (e.g., Pradhan and Ravallion, 2000; Fafchamps and Shilpi, 2008; Farid and Lazarus, 2008). Yet, to the best of our knowledge, no other studies have used the subjective well-being approach to analyze the performance of contract-farming in developing countries. We therefore believe our approach can complement the above mentioned income-based evaluations of contract-farming as well as the more qualitative literature focusing on non-monetary outcomes, and provide insights in the subjective well-being literature.

We use original panel data from a two-round farm-household survey to analyze the impact of contract-farming on self-reported happiness in the Niayes region in Senegal. The fact that we have panel data allows us to correct for unobserved heterogeneity and come to more accurate and unbiased estimates of the impact of contract-farming on farmers' welfare. This is a huge advantage compared to previous empirical studies that used cross-sectional data. Especially when using subjective measures of welfare, correcting for unobserved heterogeneity is important as these subjective measures are likely highly correlated with individual unobserved factors such as personality traits (Stewart *et al.*, 2005; Tkach and Lyubomirsky, 2006; Furnham and Christoforou, 2007).

In addition, the sector we analyze is particularly well-suited to study the welfare impact of contract-farming. The region is a main sourcing area for fruit and vegetable exporting companies. Due to dynamics and structural changes in the export sector, there is a substantial amount of farmers in the region who recently moved in or out contract-farming schemes with the export industry. These dynamics allow us to make a good assessment of the welfare impacts of contract-farming using panel data.

The remainder of the paper is structured as follows. The next section includes a conceptual discussion on the link between contract-farming and subjective well-being. In Section 3, we briefly describe our case-study and the collection of survey data. In Section 4, we present some descriptive statistics on contract-farming and differences in income and self-reported happiness. In Section 5, we specify different econometric methods and models to identify the causal impact of contract-farming on self-reported happiness, and discuss the results of the models. We draw some final conclusions in Section 6.

2. Contract-Farming and Subjective Well-Being: A Conceptual Discussion

An increasing number of studies use a subjective well-being approach instead of the common income-based measure to analyze welfare questions. Subjective

well-being (SWB), happiness, or life satisfaction[2] reflects people's own assessment of their situation. In the words of Veenhoven (1991), happiness is conceived as the degree to which an individual judges the overall quality of his life as favorable. By expressing their feelings on single or multiple scales, individuals tell how they view their life as a whole, or some particular domain of life, as favorable (Powdthavee, 2007).

There is an emerging empirical literature on how self-reported happiness is related to income, mostly pointing to a positive effect of income on happiness in within-country analyses (e.g., Clark *et al*., 2008). In other words, at a given point in time higher income is related to a higher score of reported happiness. In addition, self-reported happiness is increasingly used as a welfare indicator to address varying social and economic questions; for example, to study migration (Knight and Gunatilaka, 2008), criminal victimization (Powdthavee, 2005; Di Tella *et al*., 2009), race (Kingdon and Knight, 2007), sexual behavior (Blanchflower and Oswald, 2004), and political aspects (Di Tella and MacCulloch, 2005; Di Tella *et al*., 2007). Labor market issues are also increasingly analyzed using a subjective well-being approach, resulting in a recent stream of literature on job satisfaction (e.g., Clark and Oswald, 1996; Clark 2003; Böckerman and Ilmakunnas, 2005). This literature states that job satisfaction is importantly determined by non-wage aspects of employment, such as job security and work flexibility, and investigates how job satisfaction is related to overall life satisfaction.

In the same vein as the subjective well-being literature on labor markets and employment contracts, we can link subjective well-being to contract-farming. In the same way that employment is considered a very relevant domain of life for workers in high-income countries such that non-monetary employment aspects determine overall life satisfaction, are agricultural production and marketing very relevant domains of life for rural farmers in developing countries. Non-monetary aspects of agricultural production and marketing might therefore be important in determining farmers' satisfaction.

Contract-farming is an institutional arrangement between farmers and downstream buyers, such as processors, traders, or exporters. It usually involves the provision of inputs and services to the farmer in return for the supply of produce to the buyer. The prices set in a contract, as well as other non-monetary aspects of a contract, can have important effects on farmers' happiness (Cai *et al*., 2008). First, participation in contract-farming might positively affect farmers' happiness because it leads to higher incomes. Many studies have documented that contract-farming has a large and positive effect on farmers' income, especially when it concerns contracts for high-value export production. In previous work and for the present case-study, Maertens and Swinnen (2009) have estimated that contract-farming for fresh produce exports increases farmers' income by more than 100 percent. Given that income is usually positively associated with happiness, contract-farming could positively influence farmers' happiness.

[2]Several authors use these terms interchangeably even though there are different aspects of life, called domains, such as health, financial situation, job, leisure, housing, and environment (Van Praag *et al*., 2003). See Fischer (2009) for a recent review of these concepts.

Second, contract-farming may change production and marketing risk for farmers and thereby affect their welfare and subjective well-being (Glover and Kusterer, 1990; Key and Runsten, 1999). Agriculture is intrinsically a risky business due to variability in agro-climatic conditions and volatility in commodity markets. Contract-farming may reduce or increase the risk that farmers face. On the one hand, signing a contract for the delivery of produce reduces farmers' marketing risk of finding a buyer after harvest and having access to the market. In addition, if contracts involve the provision of inputs and credit by buyers, production risk may reduce for farmers as it is shared with buyers. On the other hand, contracts entail a risk of contract breach by the buyer (e.g., when demand in international markets is low), which increases farmers' risk. If contracts involve high-standards produce for export markets—as in our case-study—the risk of produce refusal due to non-conformity with requirements and standards adds to farmers' risk. The risk or change in risk entailed in contract-farming may positively or negatively affect farmers' subjective well-being.

Third, through contracting with buyers, farmers lose some autonomy over their crops and plots, and become more dependent on the buyers. This is especially the case when contracts entail agreements on management practices (e.g., when to plant and harvest, how much and which pesticides to use). This loss in autonomy over their own farm enterprise may negatively affect farmers' subjective well-being (MacDonald *et al*., 2004).

Fourth, producing under contract may require certain changes in attitude, production and management practices. Contracting for export markets usually entails specific production and marketing requirements such as in-time delivery, adapted pesticide use, etc. On the one hand, these changes may negatively affect farmers' happiness because they create additional pressure and lead to more strenuous efforts from farmers. Changes in the production process may also negatively affect farmers' subjective well-being because of a higher labor intensity of production (Singh, 2003). On the other hand, management changes embedded in contracts may also positively affect farmers' happiness. If farmers get training on best agricultural practices as part of contracts, this might positively influence their well-being. Also, adapted use of pesticides and other chemicals may lead to better health conditions—as shown by Asfaw *et al*. (2010)—and positively influence farmers' well-being. Finally, having a contract with a buyer may add to farmers' self-esteem and positively influence their happiness.

The subjective well-being framework allows us to combine the above described monetary and non-monetary aspects of contract-farming. We believe that using reported happiness data from rural farmers offers a general, alternative, and complementary framework to study how participation in contract-farming affects the well-being of rural farm-households.

3. Background and Data Collection

We use original data from a panel survey among farm-households in the *Niayes* region in Senegal. This region is one of the two main horticulture regions in the country, and the main region from where exported mangos and beans originate. Horticulture exports from Senegal have increased sharply during the

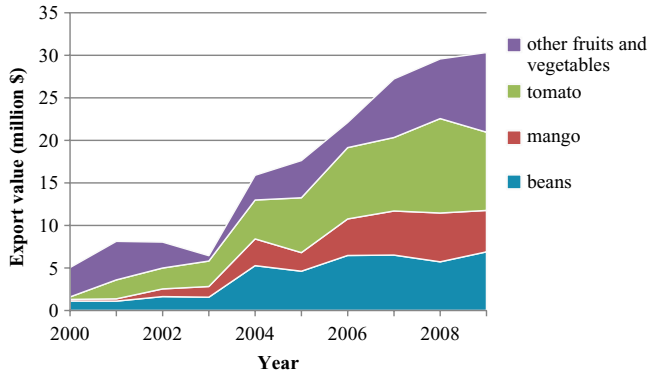

Figure 1. Exports of Fruits and Vegetables from Senegal, 2000–09
Source: Comtrade (2010).

past 15 years; from less than US$2.5 million in 1995 to more than US$30 million in 2009 (Figure 1). Apart from beans and mangos, mainly sourced from the *Niayes* region, tomatoes is also an important export crop. Apart from some small volumes to neighboring countries, exports are mainly destined for markets in the EU. The horticulture export boom in Senegal has caused recent dynamics in contract-farming in the *Niayes* region. Export companies source primary produce through contract-farming with local smallholder farms or through own vertically integrated estate production, or a combination of both. Yet, the sourcing strategy of exporting companies has changed tremendously over the past decade. At first, when exports of beans started to increase rapidly, almost the entire production was sourced from smallholders on a contract basis. However, with increasing food standards in the EU, the largest exporters shifted their sourcing approach. As part of a strategy to become GlobalGAP certified, they shifted toward own vertically integrated estate production on land leased from the government. Using data from interviews with export companies, it has been estimated that the share of beans that are procured through smallholder contract-farming decreased from 95 percent in 2000 to 48 percent in 2010 (Maertens and Swinnen, 2009; Colen *et al.*, 2012). Mango exports started to increase rapidly in more recent years, and sourcing in this sector is still mainly based on contract-farming with smallholder producers. Also in this sector a shift is expected in the future as some larger exporters already started to invest in establishing their own mango orchards.

Household survey data were collected in the *Niayes* region in 2007 and 2010. Stratified random sampling was used to select 451 farm-households in 36 villages in four rural communities in the region. Households holding a contract for the production of beans or mango for the export industry were oversampled. The same households were visited again in 2010. The attrition between the two rounds was only nine households, or 2 percent of the original sample. As subjective well-being is subjective, we work with a sub-sample of 404 households where the respondent (usually the household head) was the same person over the two survey rounds. So, we use a total sample of 808 observations, which is a balanced panel of 404

households in two years. In the case-study region, some farmers have lost their access to contracts (mostly for bean production) while others have gained access to contracts (mostly for mango production) in recent years. This is also reflected in our sample. These dynamics make this case-study particularly interesting to evaluate the impact of contract-farming on farmers' well-being. The fact that a substantial amount of farmers have moved in and out of contract-farming schemes in recent years, and the fact that we collected panel data over those years, makes correcting for unobserved heterogeneity through fixed effects or other estimators feasible.

The survey provides general data on household demographic characteristics, land and non-land asset holdings, agricultural production and marketing, contract-farming (including recall data), off-farm employment and income, non-labor income, credit, and savings. The data allow calculating total household net income from different farm and non-farm sources.

4. Contract-Farming and Well-Being: Descriptive Statistics

The survey data reveal that the share of local farm-households involved in contract-farming, either for bean or for mango exports, has steadily increased since the mid 1990s until 2000 (Figure 2). Bean contract-farming increased until 2000 when about 25 percent of households in the study region produced beans under contract with the export industry. From 2000 onwards, when the largest exporters partially shifted their sourcing strategy from smallholder contract-farming to own integrated estate production, the share of bean contract farmers dropped sharply to reach 3 percent in 2010. From 2005 onwards, mango contract production became important and by 2010 about 16 percent of farmers in the region were selling mangos under contract with exporters.

Given these dynamics in contract-farming, our sample includes farmers who were contract-farmers in both survey years, farmers who were contract-farmers

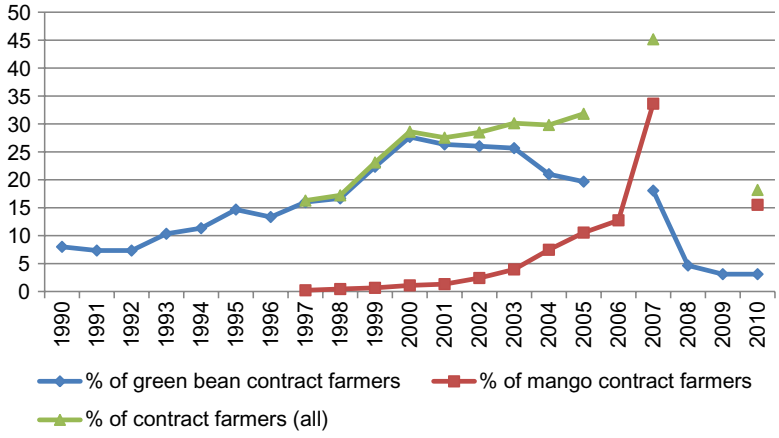

Figure 2. Share of Households Involved in Contract-Farming, 1990–2010

Source: Estimated from household survey data.

TABLE 1
Distribution of Contract and Non-Contract Households in the Sample

	2010		
2007	Contract Farmers	Non-Contract Farmers	Total
Contract farmers	43	62	105
	10.6%	15.3%	26.0%
Non-contract farmers	39	260	299
	9.7%	64.4%	74.0%
Total	82	322	404
	20.3%	79.7%	

Source: Calculated from households survey data.

only in 2010 or only in 2007, and farmers who were not contract-farmers in any of the two survey years (Table 1). This offers a unique case to evaluate the welfare impact of contract-farming.

Before we assess welfare differences across households, we compare some key household characteristics across contract and non-contract farm-households with pooled data from the two survey rounds. This comparison reveals that there are significant differences in some demographic characteristics and in asset ownership across households (Table 2). Farm-households producing beans or mangos under contract with the export industry have significantly larger households with more adult workers and more children. The share of female headed households is significantly lower for contract farmers and the number of wives significantly larger.[3] The share of ethnic Wolof (the main ethnic group in Senegal) households is significantly larger for mango contract farmers and smaller for bean contract farmers. Education is found to be significantly higher for bean contract farmers but not for mango contract farmers. Contract farmers, both bean and mango contractors, have significantly more land, and mango contractors also significantly more livestock holdings. Housing conditions, with indicators such as having a non-dirt floor in the house and using non-wood energy sources, differ slightly across contract and non-contract households. In summary, these figures indicate that selection into contract-farming is not random: it seems to be relatively better-off households with more land and livestock assets and more labor resources that engage in contract-farming.

To address farmers' well-being, we first look at a conventional measure of well-being by comparing total household income across contract and non-contract farmers. This is done for the two survey years in Figure 3. Household incomes were much lower in 2007 than in 2010, which can be attributed to unfavorable climate conditions in 2007 when a severe drought resulted in low yields and corresponding low incomes. The figure reveals that in general contract farmers have higher incomes than non-contract farmers. This holds for both years, with the average income of contract farmers being 38 percent larger than for non-contract farmers in 2007 and 83 percent larger in 2010. These are large and significant differences: the test statistics for a comparison of mean income between contract

[3]A large share of households in the sample, about 60 percent, are polygamist.

TABLE 2

Comparison of Contract and Non-Contract Households, Pooled 2007 and 2010 Data

	Total Pooled Sample	Non-Contract Farmers	All Contract Farmers	Mango Contract Farmers	Bean Contract Farmers
Number of households	808	621	187	125	73
Demographic characteristics					
Number of adults in the household	8.46 (4.38)	8.14 (4.22)	9.54 (4.71)**	9.93 (4.64)***	8.89 (4.87)*
Number of children in the household	4.16 (3.19)	4.02 (2.95)	4.63 (3.86)**	5.18 (4.18)***	3.49 (2.80)*
Age of the household head	55.5 (12.6)	55.3 (12.5)	56.3 (12.9)	58.4 (12.6)***	52.7 (12.4)**
Female-headed household	3.34% (0.18)	4.19% (0.20)	0.53% (0.07)**	0.80% (0.09)**	1.37% (0.12)
Years of education of the household head	1.65 (3.54)	1.67 (3.56)	1.58 (3.51)	1.14 (2.85)*	2.38 (4.44)*
Ethnic Wolof household	66.0% (0.47)	64.4% (0.48)	72.7% (0.45)**	80.0% (0.40)***	61.6% (0.49)
Number of conjoint of the household head	1.62 (0.89)	1.55 (0.88)	1.85 (0.90)**	1.90 (0.82)***	1.75 (1.05)**
Asset ownership					
Landholdings (ha)	3.55 (3.74)	2.90 (3.30)	5.71 (4.29)***	6.72 (4.24)***	4.11 (4.01)***
Livestock units (TLU)	2.49 (5.66)	2.23 (5.65)	3.35 (5.60)***	3.83 (5.98)***	2.48 (4.41)
Having a non-dirt floor in the house	89.7% (0.30)	90.0% (0.30)	88.8% (0.32)	92.0% (0.27)	84.9% (0.36)*
Using a non-wood energy source	13.4% (0.34)	14.7% (0.35)	9.1% (0.29)**	3.20% (0.18)***	19.2% (0.40)

Notes: Figures in brackets are standards deviations.
TLU = Tropical Livestock Units (1 TLU equals 1 cow/horse, 0.8 donkeys, and 0.2 sheep/goat).
Comparisons are made between contract and non-contract households using t-tests. Standard deviations are indicated in parentheses.
*p < 0.10; **p < 0.05; ***p < 0.01.
Source: Calculated from survey data.

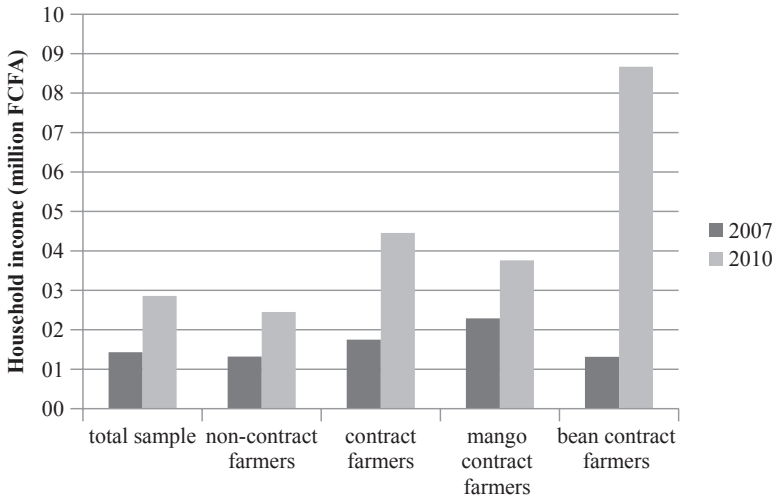

Figure 3. Average Household Income for Contract and Non-Contract Households in 2007 and 2010
Source: Calculated from household survey data.

and non-contract households are t = –2.779 and t = –4.599 for 2007 and 2010 respectively, which are both significant at the 1% level.

When further distinguishing between mango and bean contract farmers, we observe that mango contract farmers have a higher average income than non-contract farmers in both years while bean contract farmers have a higher income only in 2010. Yet, the income of bean contract farmers was about 250 percent higher than the income of non-contract farmers in 2010, while for mango contract farmers in the same year the difference was much less (53 percent). This shows that bean contract-farming leads to more volatility in income and hence involves a higher risk than mango contract-farming. This includes a higher production risk because bean yields are more severely affected by drought than yields of the mango, a tree that is drought tolerant. This might also include marketing risk as there is no—or only a very thin—local market for beans, and in case of non-conformity to prevailing quality and marketing standards in the export market—for example, due to a lack of water—farmers do not easily find an outlet for their beans.

In the 2007 survey we specifically asked contract-farmers about their perceived benefits from contract-farming. This can shed some light on the monetary versus non-monetary benefits of contracts. A summary of the answers to these explicit survey questions for 59 contract-farmers is given in Table 3. The figures reveal that farm-households appreciate contract-farming because it gives them higher prices (11.86 percent), more stable prices (45.76 percent), a higher income (15.25 percent), more stability in income (30.51 percent), or better access to credit (62.71 percent) and inputs (47.46 percent). This suggests that contract-farming has an impact on the well-being of farmers besides the direct impact it has on income.

Finally, we turn to a measure of subjective well-being for households with and without contracts. Several indicators of subjective well-being are used in the

TABLE 3
CONTRACT FARMERS' PERCEPTION OF BENEFITS FROM CONTRACT-FARMING, 2007

Benefits	An Important Benefit (share of contract-farmers, observations from 59 contract-farmers)	The Main Benefit (share of contract-farmers, observations from 59 contract-farmers)
Higher prices	11.9	1.7
Higher income	15.3	na
Stable prices	45.8	6.8
Stable income	30.5	3.4
Warranted (export) market	66.1	22.0
Access to modern inputs	47.5	8.5
Access to credit (inputs in kind)	62.7	17.0
Experience with new technologies	17.0	na
Source of income during the counter season	37.3	5.1
Other benefits	10.2	8.5

na: not available.
Source: Calculated from household survey data.

empirical literature (Fischer, 2009). Possible indicators are perceived adequacy of consumption or perceived rank on the wealth ladder, which have been used in a developing country context by Fafchamps and Shilpi (2008) and Ravallion and Lokshin (2001). Most commonly used indicators are self-reported happiness or self-reported satisfaction with life, which reflects people's own assessment of their situation (Alesina *et al*., 2004; Di Tella *et al*., 2007). In our study we use self-reported happiness as an indicator of subjective well-being.

The survey includes a question on self-reported happiness. Respondents were asked to rate their own personal happiness on a scale from 1 to 7, from "very unhappy" to "very happy." As both extremes 1 and 7 were only observed in 4.8 percent of the cases, the happiness variable was redefined into an ordinal variable of five categories: "unhappy," "more or less unhappy," "not unhappy/not happy," "more or less happy," and "happy." For some analyses, we redefine this categorical happiness variable into a dummy variable which equals one if the reported happiness is "happy" and zero otherwise. The reported level of happiness is generally much higher in 2010 than in 2007, and also the difference between contract and non-contract farmers is larger in 2010 than in 2007 (Figure 4). In 2010, 68 percent of contract farmers and 59 percent of non-contract farmers reported being happy, while in 2007 these figures are 29 percent for contract famers and 27 percent for non-contract farmers. These differences between the years are likely related to the generally low level of income in the year 2007, which is consistent with other studies that find that income is an important determinant of subjective well-being.

Statistical tests are consistent with these observations. We test for differences in the categorical happiness variable using Pearson's chi^2 tests and for differences in the binary happiness variable using t-tests (Table 4). These tests reveal that reported happiness is significantly higher for contract farmers than for non-contract farmers in 2010 but not in 2007. We also find that reported happiness is higher in 2010 than in 2007, whether or not farmers gained or lost access to contracts.

Obviously, the observed differences in reported happiness between contract and non-contract farm-households cannot be interpreted as a causal impact of

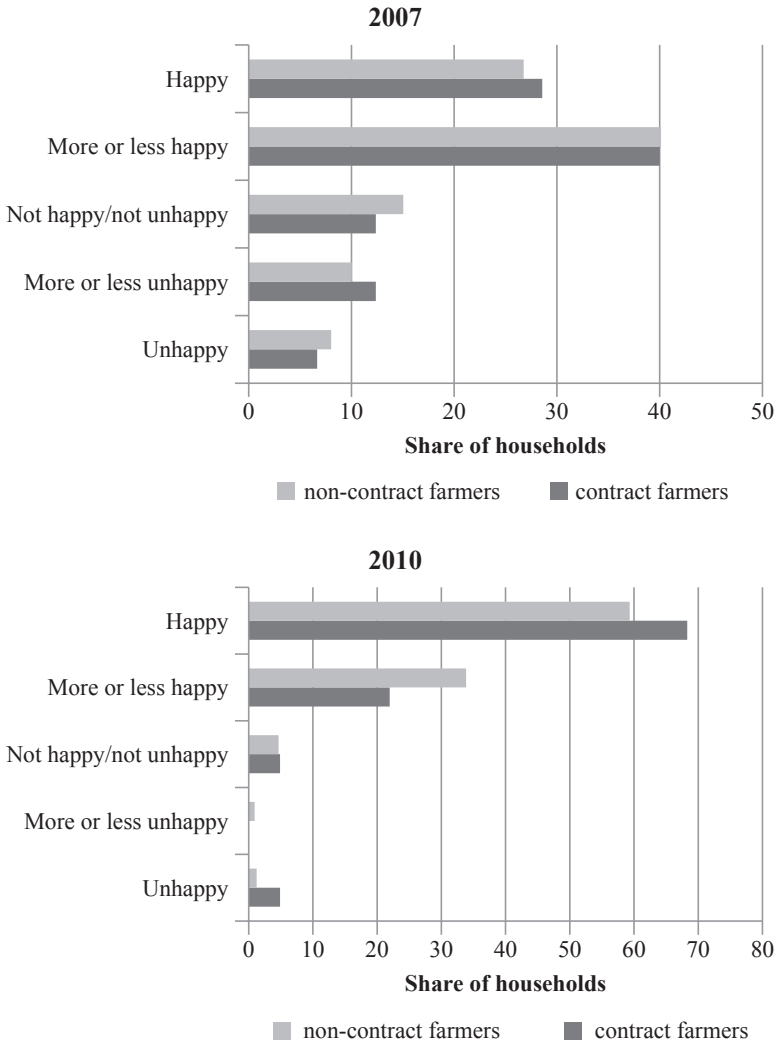

Figure 4. Differences in Reported Happiness for Contract and Non-Contract Households in 2007 and 2010

Source: Calculated from household survey data.

contract-farming on subjective well-being. Given that contract and non-contract farmers differ with respect to certain demographic characteristics and asset ownership, selection bias is very likely. Part of this selection bias is caused by observed heterogeneity or observed factors such as labor and land resources being correlated with both contract-farming and happiness (observed heterogeneity). Part of the selection bias might be caused by unobserved heterogeneity or unobserved factors such motivation and ability being correlated with both contract-farming and happiness. In the following section we use econometric methods to correct for

TABLE 4
COMPARISON OF REPORTED HAPPINESS FOR CONTRACT VERSUS NON-CONTRACT FARMERS AND FOR 2007 VERSUS 2010

Comparison of Happiness	Pearson chi^2 Test, Categorical Variable for Happiness	t-Test, Dummy Variable for Happiness
All contracts		
Non-contract versus contract farmers, 2007	1.07	–0.36
Non-contract versus contract farmers, 2010	8.94*	–1.49*
2007 versus 2010		
All farmers	124.91***	–10.31***
Contract in 2007, no contract in 2010	13.89***	–3.35***
No contract in 2007, contract in 2010	23.71***	–5.09***
Contract in 2007 and 2010	29.33***	–6.19***
No contract in 2007 and 2010	68.07***	–7.02***
Mango contracts		
Non-contract versus contract farmers, 2007	5.89	0.72
Non-contract versus contract farmers, 2010	8.64*	–1.16
2007 versus 2010		
Contract in 2007, no contract in 2010	6.13*	–2.47***
No contract in 2007, contract in 2010	22.26***	–4.78***
Contract in 2007 and 2010	23.46***	–5.48***
No contract in 2007 and 2010	83.59***	–7.82***
Bean contracts		
Non-contract versus contract farmers, 2007	2.01	–0.97
Non-contract versus contract farmers, 2010	5.48	–0.80
2007 versus 2010		
Contract in 2007, no contract in 2010	13.95***	–3.38***
No contract in 2007, contract in 2010	8.00**	na
Contract in 2007 and 2010	4.13	–1.73*
No contract in 2007 and 2010	103.25***	–9.30***

*p < 0.10; **p < 0.05; ***p < 0.01.
Source: Calculated from household survey data.

this selection bias and estimate the causal effect of contract-farming on subjective well-being.

5. REGRESSION ANALYSIS

5.1. *Econometric Methods*

To estimate the causal effect of contract-farming on reported happiness, we consider the following general model:

$$(1) \qquad Happiness_{it} = \alpha + \tau T + \beta contract_{it} + \sum_j \lambda_j X_{j,it} + \sum_k \gamma_k Z_{k,i} + e_{it},$$

where e_{it} is the error term, T are fixed time effects, and α, β, λ, τ and γ are coefficients to be estimated.

The dependent variable *Happiness* is the self-reported happiness of respondent i at time t. It is a categorical variable with five happiness categories (happy, more or less happy, not happy/not unhappy, more or less unhappy, and unhappy). We use two different sets of estimations. In a first set of estimations we assume ordinal

comparability in subjective well-being and treat the happiness variable as ordinal, meaning that a happiness score of 4 corresponds to a higher welfare level than a happiness score of 2 but not necessarily to a welfare level that is twice as high. In a second set of estimations we assume cardinal comparability in self-reported happiness and treat the happiness variable as a cardinal or continuous variable—as psychologists often do. The ordinal comparability assumption might seem more correct, but according to Ferrer-i-Carbonell and Frijters (2004), assuming ordinal or cardinal comparability does not lead to substantial differences in estimates while cardinality increases the scope for using econometric methods to correct for unobserved heterogeneity. We will compare results from both sets of estimations.

The main explanatory variable of interest, *contract*, is contract-farming, a binary time-varying variable equaling 1 if the household has a contract in a specific survey year and 0 otherwise. We run separate regressions for contracts in general and for bean and mango contracts specifically. In addition, the model includes a vector of time varying explanatory variables X_{it} and a vector of time constant explanatory variables Z_i. The first includes time varying household demographic characteristics such as the age of the household head, the number of adult household members, the number of children, and the number of wives in the household. X_{it} also includes a measure of household income or wealth. We use two different specifications: specification A, with X_{it} including household income (and where possible the square of household income); and specification B, with X_{it} including land and livestock ownership and two housing indicators (having a non-dirt floor and using non-wood energy sources). The second includes time constant demographic characteristics such as the gender, the education level, and the ethnicity of the household head.

The model also includes a measure of comparison income, which is a time varying factor and hence captured by X_{it}. This comparison income measure accounts for the fact that individuals compare their income relative to a norm and feel happy as long as their income is larger than the reference income. The comparison income hypothesis is common in the subjective well-being literature and states that a rise in the income level of the reference group might reduce or even eliminate the effect of a rise in the own income on subjective well-being (McBride, 2001). In the subjective well-being literature this is put forward as an explanation for the often observed discrepancy between reported happiness and income. For a given distribution of income, higher income might be matched with a lower reported happiness score. A concern when analyzing relative concepts influencing subjective well-being is the choice of the reference group. There is no strict indication about this issue in the literature. Some studies use age cohorts or race groups as reference group (Powdthavee, 2005; Kingdon and Knight, 2007), others use locality or space-based references like village, district, or province (Knight and Gunatilaka, 2008). In our model we use rural communities as space-based comparison groups and assume that respondents compare themselves to others within the rural community they belong to.[4] We use a measure of comparison income

[4]The use of the community (rather than the village) was guided by the fact that several villages within a given community are close to each other. Moreover, when we used the village as the space-based comparison unit, the main estimation results (not reported here) did not change.

which is defined as the average household income of the reference group. Formally, $\text{other's income}_h = \frac{\sum_i income}{N_i}$, where N_i is the number of households i who belong to the same rural community as the household h, but excluding household h.

Two important sources of bias can arise when identifying welfare effects from subjective data: endogeneity and heterogeneity problems (Ravallion and Lokshin, 2001; Fischer, 2009). We use four different estimation methods to analyze the causal effect of contract-farming on reported happiness. First, we ignore the time dimension of the data and use pooled ordered probit and pooled ordinary least squares (OLS) models in the estimations assuming ordinarily and cardinality respectively. Second, we account for the panel nature of the data and estimate random effects models where the error term in the model becomes:

$$e_{it} = u_i + \varepsilon_{it}, \tag{2}$$

with u_i, the individual random effect and ε_{it}, the error term. By including a large set of time variant and time constant covariates, these methods can correct for observed heterogeneity.

Additional methods are used to relax the assumption that the individual random effect u_i is orthogonal to some observable explanatory variables. It is particularly problematic to assume that the main explanatory variable of interest, *contract*, is orthogonal to the individual random effect. Participation in contract-farming is likely correlated with unobserved personality traits such as optimism, intelligence, ability, or motivation that are also correlated with happiness. If so, regression results from pooled and random effects regressions might be biased and inconsistent. It has been shown in psychology that especially time invariant personality traits influence self-reported happiness (Hinks and Davies, 2008). We deal with this time invariant unobserved heterogeneity using two additional methods.

The third method we use is a fixed effect regression that accounts for the correlation between the fixed effects, u_i and the observables explanatory variables. It is important to notice that while it is straightforward to use this method under the cardinality assumption, it is difficult to estimate the fixed effect regression with ordered probit—assuming ordinal comparability. One alternative is to estimate the usual ordered probit regression by including the individual' dummies u_i. However, this practice can lead to inconsistent estimates, as we have only two observations per individual. Some studies (Ferrer-i-Carbonell, 2005) address this problem by estimating random-effects ordered probit and allowing for correlation between the individual random effects and some of the observable variables, using the Mundlak (1978) transformation. We follow this approach and estimate a modified version of equations (1) and (2) using random-effects ordered probit with the Mundlak transformation:

$$Happiness_{it} = \alpha + \tau T + \beta contract_{it} + \sum_j \lambda_j X_{j,it} + \sum_k \gamma_k Z_{k,i} + \sum_l \varphi_l \bar{Y}_{l,i} + v_i + \varepsilon_{it}, \tag{3}$$

TABLE 5

Summary of Regression Results on the Impact of Contract-Farming on Subjective Well-Being Using Different Models and Specifications

	Assuming an Ordinal Happiness Variable		Assuming a Cardinal Happiness Variable	
	Spec. A	Spec. B	Spec. A	Spec. B
Pooled ordered probit/pooled OLS	0.008	–0.045	0.008	–0.045
Random effects ordered probit/regression	0.035	–0.018	0.035	–0.018
Random effects ordered probit with Mundlak transformation/fixed effects regression	0.330**	0.360**	0.330**	0.360**
Hausman–Taylor regression			0.008	–0.045

*p < 0.10; **p < 0.05; ***p < 0.01.
Source: Estimated from household survey data.

where:

$$u_i = \sum_l \varphi_l \bar{Y}_{l,i} + v_i. \tag{4}$$

The individual random effect u_i is thus a function of a component that is correlated to some potential endogenous variables Y—contract, household income, and education of household head—and a pure error term v_i that is not correlated to the explanatory variables. $\bar{Y}_j$ is the average of Y_j across the time and the coefficient φ is the statistical correlation corrector factor (see Ferrer-i-Carbonell, 2005).

In a final attempt, we use the Hausman–Taylor estimation in which we allow the potential endogenous variables—contract, household income, and education of household head—to be correlated with the unobserved individual-level random effect u_i. This method is based on the cardinality assumption but possesses nevertheless the advantage to keep the time invariant explanatory variables in the regression contrary to the fixed-effects regression.[5]

5.2. *Results and Discussion*

The results for the main variable of interest, contract-farming, are summarized in Table 5 for contracts in general and in Table 6 for bean and mango contracts specifically. More detailed regression results for various specifications are reported in the online Appendix, Tables A1 and A3 (estimations assuming ordinal comparability) and Tables A2 and A4 (estimations assuming cardinal comparability). Before discussing these results it is important to note that the results from specific models are qualitatively equal and quantitatively very similar whether assuming cardinality or ordinality. This confirms the conclusion of Ferrer-i-Carbonell and Frijters (2004) that assuming cardinality or ordinality does not change the results dramatically.

[5]According to Ferrer-i-Carbonell and Frijters (2004), the way time-invariant unobserved factors is taken into account in subjective well-being study is more important than assuming cardinal or ordinal comparability.

TABLE 6

Summary of Regression Results on the Impact of Contract-Farming on Subjective Well-Being Using Different Models and Specifications: Differentiation Between Mango Contract and Green Bean Contract

	Assuming an Ordinal Happiness Variable		Assuming a Cardinal Happiness Variable	
	Spec. A	Spec. B	Spec. A	Spec. B
Mango contract				
Pooled ordered probit/pooled OLS	0.017	–0.052	–0.005	–0.054
Random effects ordered probit/regression	0.060	–0.035	0.023	–0.025
Random effects ordered probit with Mundlak transformation/fixed effects regression	0.322	0.296	0.347*	0.359**
Hausman–Taylor regression			0.367**	0.363**
Green bean contract				
Pooled ordered probit /pooled OLS	–0.027	–0.063	–0.063	–0.093
Random effects ordered probit /regression	–0.030	–0.037	–0.032	–0.055
Random effects ordered probit with Mundlak transformation/fixed effects regression	0.262	0.301	0.240	0.284
Hausman–Taylor regression			0.213	0.266

*p < 0.10; **p < 0.05; ***p < 0.01.
Source: Estimated from household survey data.

Our main finding is that, when correcting for time invariant unobserved heterogeneity, contract-farming in general has a significant positive effect on subjective well-being (Table 5). We find no effect of contract-farming on happiness in the pooled regression models and the random effects models. However, the estimates from the pooled regression models and the random effects models are biased downwards because of unobserved heterogeneity. This downward bias might result from factors such as a person's temper or motivation being positively correlated with the likelihood of having a contract and negatively correlated with the person's self-reported happiness—or vice versa. With the fixed effect models and the Hausman–Taylor models we correct for this bias—assuming the unobserved heterogeneity is time invariant—and come to more correct estimates.

We do find a large and positive significant effect of contract-farming in the fixed effects models and the Hausman–Taylor models. These results are robust whether ordinal or cardinal comparability is assumed. These results imply that participation in contract-farming increases subjective well-being and that this effect can only be evaluated when selection bias caused by correlation with unobserved time invariant factors, such as personally traits, can be corrected for. The large differences in the estimated coefficients and the corresponding significance levels between the pooled regression and the random effects models on the one hand and the fixed effects and Hausman–Taylor models on the other hand, indicate that time invariant unobserved factors are strongly correlated with happiness. This is in line with conclusions from the psychology literature that personality traits are strongly related to self-reported happiness (Emmons and Diener, 1985; Stewart *et al*., 2005; Tkach and Lyubomirsky, 2006; Furnham and Christoforou, 2007).

We specifically accounted for household income as a control variable in the regressions (model specification A), and additionally control for the potential

endogenous character of this variable in the fixed effect and Hausman–Taylor regressions. Even when controlling for household income we find a positive significant effect of contract-farming on happiness. This implies that contract-farming increases happiness besides its effect through income and that non-income aspects of contract-farming—for example, reduced marketing risk, better access to inputs and credit, better access to improved technologies—improve the well-being of farmers as well. Our main finding, that contract-farming improves farmers' subjective well-being, complements earlier findings in the literature on the positive effect of contract-farming on farm income and productivity. The results also show that contract-farming has positive non-income effects on welfare and thereby contradict observations in the rural sociology literature that contract-farming reduces farmers' welfare because of a loss in autonomy and increased vulnerability.

When analyzing the effects of bean and mango contracts separately, we find some divergence in the results (Table 6). Similar to the findings above, we find a large and positive significant effect of mango contract-farming in the fixed effects models and the Hausman–Taylor models, but not in the pooled ordered probit and OLS models and the random effects models. For bean contracts, we find a positive effect in the fixed effects models and the Hausman–Taylor models, but these effects are only significantly different from zero at the 15% significance level, and only in the models where income is not controlled for (specification B). These results imply that the effect on happiness is larger for mango contracts than for bean contracts, and that the effect of bean contracts mainly comes from an income effect while for mango contracts non-income effects also affect farmers' subjective well-being. These differences might be related to a higher risk involved in bean contracting, because bean yields and quality of the produce are more vulnerable to weather shocks and because there is no local market outlet for beans in case of non-conformity with quality and marketing standards in export markets. In addition, this might be related to the cultivation of green beans being more strenuous for farmers because it involves specific management issues and because it is not a traditional crop in the region. The cultivation and marketing of mango involves less risk and is less strenuous because there is a long tradition of mango cultivation in the region, because there is a large local market, and because mango, a tree fruit, requires less management decisions and is more drought tolerant.

Apart from contract-farming, variables related to households' demographic characteristics and asset ownership have an impact on self-reported happiness as well. The estimated effects of these variables are consistent across the different models and specifications (Tables A1–A4). First, in terms of demographic characteristics, we find that having more children decreases happiness. This is in line with findings from other studies, mostly from high-income countries, that children do not necessarily increase people's subjective well-being; on the contrary, they decrease it (e.g., Ferrer-i-Carbonell, 2005). Our results confirm that this also holds in poor countries. The regression results further indicate that being polygamist and having more wives increases happiness. Similar empirical findings were observed in Malawi (Hinks and Davies, 2008) and South Africa (Moller and Welch, 1990). In addition, we find that education has a positive impact on self-reported happiness.

This was also observed by Graham and Hoover (2006) in several African countries. Further, our results indicate that belonging to the ethnic Wolof group—the main ethnic group, including about 40 percent of the population in Senegal—decreases happiness. This is somewhat surprising and contradicts earlier results from Malawi that belonging to a minority group decreases happiness (Hinks and Davies, 2008). In general, our findings on the importance of demographic factors are consistent with the basic rationale of the subjective well-being approach that non-income and non-wealth factors matter as well in determining welfare (Gerdtham and Johannesson, 2001; Ferrer-i-Carbonell, 2005; Frey and Stutzer, 2005).

Second, the regression results indicate that asset ownership and wealth are positively associated with subjective well-being. We find that land and livestock holdings have a significant positive effect on self-reported happiness. Also the indicators for better housing conditions, having a non-dirt floor, and using non-wood energy, have a positive effect on happiness, although the effect of the latter indicator is not significant in all the models. The conclusion that assets and wealth increases subjective well-being is consistent with previous empirical findings for developing countries (e.g., Kingdon and Knight, 2007; Fafchamps and Shilpi, 2008; Van Landeghem *et al.*, 2013).

Third, we find that in most models household total income has a significant positive effect on self-reported happiness. This is in line with neo-classical utility theory that income increases the bundle of consumption goods and thereby increases the utility derived from these consumption goods. It is also in line with findings from various empirical studies, from developed as well as from developing countries, that absolute levels of income, expenditures, or consumption positively affect subjective well-being (e.g., Di Tella *et al.*, 2001; Easterlin, 2001; Blanchflower and Oswald, 2004; Powdthavee, 2005; Graham and Hoover, 2006; Hinks and Gruen, 2006; Kingdon and Knight, 2006; Hinks and Davies, 2008). Further, our results indicate that the positive effect of income on subjective well-being might be decreasing such that the effect of income on subjective well-being diminishes at higher income levels. The squared income variable could however not be included in all regressions due to a lack of convergence in the models, and is only observed to be significant in the models assuming ordinal comparability. Similar indications of an inverse U-shaped relation between income and happiness were found by Di Tella *et al.* (2001) for a number of European countries and by Frijters *et al.* (2004) for Germany. Our results indicate that such an inverse U-shaped relation might hold even in poor countries such as Senegal.

Finally, we observe that comparison income has a significant negative effect on happiness. The effect is highly significant and consistent over the different models and specifications. This is in line with other empirical studies which find a negative effect of comparison income, consumption, or wealth on subjective well-being (e.g., Clark and Oswald, 1996; McBride, 2001; Blanchflower and Oswald, 2004; Ferrer-i-Carbonell, 2005; Luttmer, 2005; Hinks and Davies, 2008; Van Landeghem *et al.*, 2013). Such a negative effect of comparison income (or wealth) means that one feels less happy if the income (or wealth) situation of one's peers improves and can be interpreted as a jealousy effect.

6. Conclusion

In this paper we analyze the impact of contract-farming on farmers' welfare using subjective well-being as an alternative non-monetary measure of welfare and using panel data and fixed effects models to correct for time invariant unobserved heterogeneity. This approach is innovative as contract-farming has mostly been analyzed with cross-sectional data and using income-based measures of welfare, or using qualitative approaches. The main conclusion from the analysis in this paper is that contract-farming has a positive impact on farmers' welfare. An important part of this positive welfare effect is an income effect, stemming from contract-farming leading to higher incomes. This conclusion corroborates earlier findings from the agricultural and development economics' literature that contract-farming positively affects farmers' profits and incomes. We find diverging effects for mango and bean contracts. While bean contracts contribute less—or not at all—to farmers' happiness, mango contracts have a strong positive effect on happiness and this comes from an income as well as a non-income effect. These differences might be related to issues of risk, and suggest that contract-farming contributes more to farmers' subjective well-being under certain conditions and contract design. Nevertheless, our results contradict findings from the rural sociology and political economy literature that contract-farming has adverse effects on farmers.

We acknowledge that our conclusions on a positive welfare effect of contract-farming are drawn from a specific case-study of contracting for high-value export production in a country where these exports have grown tremendously. We should be careful with generalizing these results but we believe that our results do challenge arguments in the literature that contract-farming has negative non-monetary effects on farmers. More empirical research on this issue would be needed to come to more general conclusions.

This paper also makes a contribution to the subjective well-being literature. Several empirical studies have shown that in high-income countries income has a positive but decreasing impact on subjective well-being and that comparison income has a negative effect. The evidence on this for developing countries is limited. Our study provides evidence that similar relationships between income and subjective well-being also hold in a poor African country.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix

Table A1: Estimation Results of Reported Happiness Using Different Methods and Model Specifications, Assuming Ordinal Comparability

Table A2: Estimation Results of Reported Happiness Using Different Methods and Model Specifications, Assuming Cardinal Comparability

Table A3: Estimation Results of Reported Happiness Using Different Methods and Model Specifications, Assuming Ordinal Comparability: Differentiation Between Mango Contract and Green Bean Contract

Table A4: Estimation Results of Reported Happiness Using Different Methods and Model Specifications, Assuming Cardinal Comparability: Differentiation Between Mango Contract and Green Bean Contract